REPORT NO. 77-2-8

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FURADAN® (CARBOFURAN) APPLICATION AND AVIAN MORTALITY ON CATAWBA TIMBER COMPANY'S IRRIGATED PINE SEED ORCHARD, CATAWBA, S.C.

U. S. FOREST SERVICE
PINEVILLE, LOUISIANA

U. S. DEPARTMENT OF AGRICULTURE -- FOREST SERVICE
SOUTHEASTERN AREA, STATE AND PRIVATE FORESTRY
RESOURCE PROTECTION UNIT, FOREST INSECT AND DISEASE MANAGEMENT GROUP

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by

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INTRODUCTION

In the fall of 1976, seed orchard managers in the South were informed that Furadan® (carbofuran) 10 G granules would be registered for use against coneworms, seedbugs, coneborers, and cone beetles (label - Appendix I). This registration came about through 1974 and 1975 southwide testing efforts conducted in 30 seed orchards and coordinated by the Southern Seed Orchard Pest Committee4/. In these tests, Furadan was applied to individual trees by hand-held devices and incorporated into the soil using a rake or disc.

The above-mentioned cooperative tests were very successful. Not only was excellent insect control achieved, but no adverse environmental effects were noted. An important problem not dealt with was how Furadan would be operationally incorporated into the soil.

During the winter of 1976, Forest Insect and Disease Management, in cooperation with the Southern Seed Orchard Pest Committee, operationally tested the Zip Seeder® (manufactured by Midland Mfg. Co.) and the disc method for incorporation of Furadan granules

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4/ This committee is made up of nine representatives: one each from the three southern seed orchard cooperatives, one from states not represented by a cooperative, one from TVA, one representing the Universities, one from the Southeastern Forest Experiment Station, USFS, one from State & Private Forestry, USFS, and one from the National Forest System, USFS.

(4 to 8 oz/in tree diameter) in three pine seed orchards in Mississippi, Georgia, and Virginia. Both methods failed to adequately incorporate the granules and bird mortality occurred in the Mississippi and Georgia tests. No bird mortality occurred in the Virginia orchard, probably because of the lack of migrating birds at the time of application. While Furadan applied by either method prevented a sizeable loss in seed yield, these techniques cannot be recommended for use because the potential for bird mortality might jeopardize the registration.

In 1977, Forest Insect and Disease Management tested the John Deere Pow'r Till Seeder® as a Furadan applicator in four orchards located in Louisiana (Continental Can), Mississippi (National Forests-Erambert), Florida (Buckeye Cellulose Corp.), and South Carolina (International Paper Co.). Incorporation of the Furadan exceeded 98 percent on all orchards. Avian mortality never exceeded 45 for any 30-acre treatment block over a seven-day period.

During the past year, interest was shown the North Carolina Cooperative and FMC in evaluating incorporation of Furadan granules by using irrigation systems. Because of this interest, State and Private Forestry agreed to evaluate this method at the Catawba Seed Orchard in Catawba, South Carolina, in the winter of 1977. This was the first year Furadan was applied operationally at this orchard.

OBJECTIVES

The objectives of this evaluation were:

1. Can Furadan be broadcast and watered in without significant avian mortality taking place, and
2. Can Furadan be applied at the registered dosage rate using this technique and provide seed and cone insect control.

Only objective one will be dealt with in this report. Objective two cannot be answered until cone collection and cone analysis have taken place (December 1, 1977).

METHODS

I. Furadan Application and Avian Mortality

The 20-acre Catawba Loblolly Pine (Pinus taeda L.) Seed Orchard is located in Catawba, SC. Seventeen acres were treated on February 8 and 9 with Furadan 10 G and three acres left untreated. Twenty-eight hundred and twelve kg (6200 lbs) of Furadan were applied in a 2.4 m (8') band on two sides of the tree from a Ford Fertilizer Spreader (Fig. 1) at the rate of .009 kg/mm (8 oz/in tree diameter). A total of 25.4 mm of rain was deposited from the sprinkler system on February 8, 9, and 10 (Fig. 2).

At 1 day prior to and 1, 2, 3, and 5 days after application of Furadan, crews walked up and down the rows in the treated orchard to locate dead birds. The efficiency of the search was determined by seeding 50 dead birds throughout the orchard. The location of these birds was known only by the wildlife specialist assigned to the project. All edges (30 m from the orchard boundary) of the treated area were searched for dead birds. At weekly intervals for the next three weeks, crews searched the treated orchard for dead birds. No seeded birds were used for these searches. The digestive system from a sample of dead birds was searched for Furadan granules.

Figure 1. Ford fertilizer spreader used to apply Furadan.

Figure 2. Irrigation system in operation.

Observations were also made and recorded as to which birds were utilizing the orchard.

II. Seed and cone insect damage prevention associated with Furadan application cannot be determined until the fall or early winter of 1977.

Four clones were selected for study with each represented by four ramets. Two ramets of each clone were located in the treated area and two ramets in the untreated area.

At cone harvest, all cones will be counted and the percent attacked by coneworms determined. Five apparently healthy cones from each ramet will be bagged separately and sent to the Eastern Tree Seed Laboratory for cone analyses. The radiographs will be returned to Forest Insect and Disease Management for interpretation and final analysis.

RESULTS AND DISCUSSION

No mechanical problems developed while Furadan was being applied. One breakdown in the irrigation system required workers to make repairs in standing water. As the irrigation system is in a 3.6 - 4.2 m (12 - 14 ft.) wide zone where no Furadan was applied, we did not expect any Furadan to be present in the water. However, rubber boots and gloves were worn to prevent exposure.

Some Furadan granules were left exposed on the ground surface (Fig. 3), and we expected dead birds. Fortunately, few dead birds were found (Table 1). However, bird activity was light as compared to other orchards tested in the John Deere Pow'r Till Seeder® pilot test this year. Of course, this would be the best time to apply Furadan.

One wren, one dove, two blue jays, four sparrows, five juncos, five robins, and six purple finches were found dead within five days after Furadan application. On February 21, one unidentified bird, two juncos, and four robins were found dead. On February 28, two unidentified birds, one dove, and one junco were found dead. No additional bird mortality occurred after this date. Of the 16 birds dissected, eight contained Furadan granules.

Cardinals and piliated woodpeckers were often seen utilizing the seed orchard. However, no loss or sickness was observed.

Scavenger activity did occur. Nineteen of 50 seeded birds were lost to scavengers. Opossums, racoons, a dog, and two birds of prey were sighted. This would indicate that some of the Furadan-killed birds were scavenged. The fate of the scavengers is unknown.

RECOMMENDATIONS

Additional evaluations will be needed before the U.S. Forest Service could recommend Furadan application via broadcast plus sprinkle irrigation. The primary reason is that the Furadan label now reads that the insecticide be incorporated into the soil and a

Figure 3. Furadan granules left exposed on sycamore leaves.

Table 1. Avian mortality and searching efficiency on the Catawba irrigated pine seed orchard, Catawba, SC, treated with Furadan on February 8 - 9, 1977.

	Days after application					
	- 1	+1	2	3	5	TOTAL
Bird mortality	1	7	8	4	4	24
% efficiency	-	78	86	94	-	87

label change would be necessary before irrigation might be considered a suitable device.[5/] Several additional evaluations would be needed under varying geographic and climatic conditions to expand the label[5/]. This method should also have to be tested where bird populations were higher.

We would not consider the bird mortality excessive. For instance, the few robins lost would have little impact on the overall population. However, we recognize that one endangered species dead could be significant, and because of this, we should always strive for no bird mortality.

The effect on scavengers of eating poisoned birds is not known. Contacts will be made with FMC to see if any information is available.

If insect control is obtained, we would suggest that the orchard take the following steps to reduce bird losses next year.[6/]

1. Scaring devices should be used for five days after application.
2. An area on the edge of the orchard or nearby should be disked to lure birds from the treated orchard.
3. One portion of the orchard contained many sycamore leaves on the ground. The accumulation of granules on these leaves

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5/ Personal communication, (Mrs.) S. J. Wendler, FMC Corporation, July 6, 1977.

6/ Next year's application should also be considered an evaluation to obtain data for a label change.

could be prevented by dragging the orchard with a light drag harrow immediately after Furadan application.

4. Apply when bird populations are low.

Forest Insect and disease management will contact the three Seed Orchard Cooperatives for possible sites of additional tests using irrigation as the method of Furadan incorporation.

APPENDIX I - Label

2834

[illegible] Net Weight

Furadan® 10 Granules

Insecticide — Nematicide

EPA Reg. No. 279-2712 AA

Active ingredient:	
*Carbofuran	10.0%
Inert ingredients:	90.0%
*2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate	100.0%

Furadan — FMC trademark U.S. Patent No. 3,474,171

KEEP OUT OF REACH OF CHILDREN.

WARNING

If swallowed, induce vomiting by sticking finger down throat or by giving soapy or strong salty water to drink. Repeat until vomit is clear. Never give anything by mouth to an unconscious person. Get medical attention. If in eyes, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention. **Note to physician:** Carbofuran is an acetylcholinesterase inhibitor. Atropine is antidotal. Give 2 mg. intramuscularly. If in eyes, use one drop of Homatropine.
For Emergency Assistance - Call 716-735-3765

PRECAUTIONARY STATEMENTS

Hazard to humans (& domestic animals).
Warning
May be fatal if swallowed or absorbed through eyes. Do not get in eyes or on clothing. Avoid contact with skin.
Environmental hazards.
This pesticide is toxic to fish and wildlife. Use with care when applying in areas frequented by wildlife or adjacent to any body of water. Birds feeding on treated areas may be killed. Keep out of lakes, ponds or streams. Cover or incorporate granules which are spilled during loading and which are visible on soil surfaces in turn areas.

Use Caution
Do not plant crops other than alfalfa, corn, peanuts, peppers, potatoes, rice, sorghum, strawberries, sugar beets, sugarcane and tobacco within 18 months of last application. Soybeans and oats may be planted the following season. Any other crop may be planted if it is not harvested or grazed.

FMC

FMC Corporation
Agricultural Chemical Division
Middleport New York 14105

DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage, disposal or cleaning of equipment. Open dumping is prohibited.
Pesticide that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies. Dispose of in an incinerator or landfill approved for pesticide containers, or bury in a safe place. Consult Federal, State or Local disposal authorities for approved alternative procedures such as limited open burning.

SPECIMEN LABEL

Directions for Use

Field Corn — Conventional, Minimum & No-Tillage
Corn Rootworms (Northern, Southern & Western), Flea Beetles, aids in the control of first generation European Corn Borer, reduce losses due to Stalk Rot by reducing the incidence of insect wounds which permit entry by the stalk rot fungi; Armyworm and Fall Armyworm control for approximately 4 to 6 weeks after planting — Use 7½ to 10 lbs. of Furadan 10 Granules per 13,000 linear feet (1 acre with 40 inch row spacing). Apply in a 7 inch band ahead of the planter press wheel and incorporate into the top 1 inch of soil by use of special covering devices or by dragging a short length of chain. —OR— Direct the granules into the planter shoe with the seed. —OR— Place the applicator tube directly behind the planter shoe so that the granules drop into the furrow and mix with the covering soil.

Southwestern Corn Borer (second to third generation) — Apply 15 to 30 lbs. per acre into the seed furrow by placing the granular application tube directly behind the planter shoe.

European Corn Borer (first generation), Wireworm — Use 20 to 30 lbs. per 13,000 linear feet (one acre with 40 inch row spacings) and apply "at planting" as above (in a covered band or in the seed furrow).

Nematodes (sting, stunt, stubby root, root knot, dagger, lesion, lance, and spiral) — Use 15 to 20 lbs. per 13,000 linear feet (one acre with 40 inch row spacing). Apply at planting time in a 7 to 15 inch band and incorporate into the top 3 inches of soil.

Field Corn — Post Plant
Northern & Western Corn Rootworm — Use 7½ to 10 lbs. per acre by banding over the row or by side dressing both sides of the row and cultivating into the soil.

Corn Applicator Indicator Setting
Furadan 10 Granules is a dense, free-flowing product which will require application equipment to be calibrated to apply the recommended amount per acre. The following are approximate settings for guidance in calibration:

Noble (fiber glass)		
Gandy (901 appl. with resilient Rotors at 4 mph)	1	
Allis Chalmers (18" wheel with tire)	6	7
E-Z Flo (Model 201-5-25 fiber glass appl.)	9	12
John Deere	RI-N29	RI-N33
International Harvester — Gate No. 1	Dial 6	Dial 8

Peanuts
Do not feed treated peanut forage to dairy animals or animals being finished for slaughter.
Nematodes (root knot, sting, stunt, lesion, ring) in Southeastern States and in Southwestern States of Texas and Oklahoma and for control of Thrips in Southeastern States — Apply Furadan 10 Granules in a band over the row prior to planting and incorporate 3 to 6 inches into the soil. Use the rate indicated below for various band widths.

Band Width	*Rate/Acre (36 inch rows)*	*Rate/1000 linear feet*
12 inches	20 to 40 lbs.	1⅛ to 2¼ lbs.
18 inches	30 to 50 lbs.	2 to 3⅛ lbs.

Thrips, Potato Leafhopper and as an aid in the control of *Southern Corn Rootworm in Southeastern States* — Use in furrow at planting, 5 to 10 lbs. per acre (36 inch row spacing); ⅓ to ⅔ lbs. per 1000 linear feet of row.

Peppers
Green Peach Aphid — (Delmarva Peninsula & South Jersey only), European Corn Borer — Make two applications of Furadan 10 Granules by sidedressing on either one or both sides of the row. Make a first application two to four weeks after transplanting using 20 lbs. per acre (equivalent to ¾ lb. per 500 linear feet with 38 inch rows). Make the second application four to six weeks later using 30 lbs. per acre (1 lb. per 500 linear feet). Do not make the second application within 21 days of harvest.

Sorghum
Greenbug - Use only on grain sorghum or sorghum grown for forage.
Use 9-12 ounces of Furadan 10 Granules per 1000 linear feet of row (7.5-10 lbs. per 13,000 linear feet). Apply directly into seed furrow. — OR — Use 12 ounces Furadan 10 Granules per 1000 linear feet of row (10 lbs. per 13,000 linear feet). Apply in a 7 inch band over the row and incorporate granules into the top 1 inch of soil by use of a press wheel, dragging a short length of chain or other suitable device.

	Pounds of Furadan 10 Granules to Apply Per Acre Using Various Row Spacings		
	20"	30"	40"
In-furrow	15-20	10-13	7.5-10
7" Band	20	15	10

Sugar Beets
Sugar Beet Root Maggot — Use 20 lbs. of Furadan 10 Granules to 23,750 linear feet of row or 4 ounces per 300 feet (equivalent to 1 acre using 22 inch row spacing). Apply granules in a 6 to 7 inch band and incorporate into the top 1 inch of soil using a suitable device.

Sugarcane
Apply Furadan 10 Granules at the rate of 2½ to 5 lbs. per 1000 linear feet of row (equivalent to 20 to 40 lbs. per acre based on 60 inch row spacings). Do not use in Hawaii.
Nematodes (root knot & stunt), Wireworm —
Plant cane Apply the above rate as a 15 inch band directly over the planted cane and cover with soil.
Wireworm (Florida only), Nematodes (Root knot & stunt) - **Stubblecane** Apply the above rate as a 15 inch band over th stubble row. Use anytime after harvest until regrowth reaches 18 inches. Cover with a 1 to 2 inch layer of soil. Covering with more than 2 inches of soil may reduce stand

Continued on back

Tobacco — Bu

Flea Beetles — Use 30 to 40 lbs. per acre. Broadcast granules over the soil surface prior to transplanting and incorporate with a suitable device.

Tobacco — Flue Cured

Nematodes (root knot & stunt), Wireworms, Hornworms, Flea Beetles and to aid in the control of Budworms — Use 60 lbs. per acre. —OR— Use 40 lbs. per acre for full season control of flea beetles and approximately 60 days control of hornworms. Apply Furadan 10 Granules before forming beds. Broadcast granules over the soil surface and incorporate 4 to 6 inches with suitable device. Form beds and plant as usual.

Cottonwood

Cottonwood Twig Borer, Cottonwood Leaf Beetle, Clearwing Borer — **In commercial plantations** use 10 to 20 lbs. per acre (12 ft. row spacing) or 2¾ to 5½ lbs. per 1000 linear feet of row. Apply during June or July to the root zone of the cutting by the use of a granular subsoil applicator as a sidedress 10 to 12 inches from the trees in a continuous band on both sides of the trees. **In Nursery plantings** use 40 lbs. per acre (40 inch row spacing) or 3 lbs. per 1000 linear feet of row. Apply during May or June to the root zone of the cutting, sidedressing 10 to 12 inches from the trees in a continuous band on both sides of the trees.

Pine Seedlings

Pales Weevil and Pitch-Eating Weevil control in pine plantations — Use 10 grams (1 teaspoon) per seedling at transplanting. Distribute the granules in a 6 inch radius on the soil around each seedling. Cover granules with soil. Do not use at planting if seedlings were treated with Furadan 4 Flowable slurry root dip.

Southern Pine Seed Orchards

Seedbugs, Coneworms, Coneborers - Use 4 to 8 ounces per inch of tree diameter. Cone beetles - Use 8 ounces per inch of tree diameter. Broadcast within the drip area of the tree and incorporate with a suitable device. Make one (1) application in winter or early spring. Do not graze or feed orchard plants or plant parts.

Siberian Elm

Elm Leaf Beetle control by commercial applicators only and in the States of Colorado, Nebraska, Kansas, New Mexico, Arizona, Utah and Wyoming only — Apply Furadan 10 Granules, before insects appear in the spring, at the rate of ½ ounce per inch of trunk circumference. Measure the circumference (girth) of the tree 3 to 4 feet above the ground. Dig one hole for each inch of girth, 3 to 9 inches deep under the drip line of the tree. Thoroughly soak area under the tree. Place granules required in each hole. Replace soil plug immediately and compress soil. Keep treated areas soaked with water for 14 days.

If Girth of tree is:	Locate Holes away from trunk	Amount of Furadan 10 Granules
1 to 10 inches	1 ft.	0.5 to 5 ounces
14 to 20 inches	3 ft.	7 to 10 ounces
24 to 80 inches	6 ft. & 12 ft. (alternating)	12 to 20 ounces
44 to 80 inches	10 ft. & 12 ft. (alternating)	22 to 40 ounces
80 inches and larger	12 ft. & 20 ft. (alternating)	40 ounces

Dealers Should Sell in Or al Packages Only.

Terms of Sale or Use On purchase of this product buyer and user agree to the following conditions:

Warranty FMC makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Except as so warranted, the product is sold as is. Buyer and user assume all risk of use and/or handling and/or storage of this material when such use and/or handling and/or storage is contrary to label instructions.

Directions and Recommendations Follow directions carefully. Timing and method of application, weather and crop conditions, mixture with other chemicals not specifically recommended, and other influencing factors in the use of this product are beyond the control of the seller and are assumed by buyer at his own risk.

Use of Product FMC's recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice.

Damages Buyer's or user's exclusive remedy for damages for breach of warranty or negligence shall be limited to direct damages not exceeding the purchase price paid and shall not include incidental or consequential damages.